

## Map Unit Properties Table

Age	Unit Name (Map Symbol) Linn (1999)	Unit Name (Map Symbol) Weist and others (1965)	Unit Name (Map Symbol) Tweto (1979)	Description	Significant Features
Quaternary		Dune sand (Qds)	Eolian deposits (Qe)	Very fine to coarse sub- rounded to well- rounded grains of clear quartz, contains some feldspar, includes dune sands and silt and Peoria Loess	Most dunes are stabilized by vegetation, serve as major catchments for recharging underlying aquifers
		Floodplain deposits (Qf)	Modern alluvium (Qa)	Unconsolidated clay, silt, sand and some lenses of gravel; cross- bedded; includes Piney Creek Alluvium and younger deposits	Bent's Old Fort National Historic Site is at the edge of this deposit
		Valley- fill deposits (Qvf) Upland deposits (Qu)		All alluvial deposits outside of the Arkansas River	Yields moderate supplies of water for irrigation, stock, and domestic use May yield small quantities of water for stock and domestic use
		Wisconsin terrace deposits (Qtw) Upper deposits (Qtw) Lower deposits (Qtw.)	Gravel and alluviums (Qg)	Generally unconsolidated clay, silt, sand, gravel, cobbles, and boulders; spotty accumulations of caliche; includes Broadway and Louviers Alluviums	Bent's Old Fort National Historic Site lies on this deposit, younger terrace deposits form the most important unconsolidated aquifer in the area, Louviers Alluvium contains fossils (Scott, 1963), higher percentage of gravel than other Pleistocene deposits
		Illinoian terrace deposits (Qti) Kansas deposits (Qk) Nebraskan deposits (Qn)	Older gravels and alluviums (Qgo)	Clay, sand, gravel, and cobbles; includes Slocum, Verdos, Rocky Flats, and Nussbaum Alluviums Illinoian: generally unconsolidated poorly sorted, contains considerable caliche (although not as much as Kansan), commonly cross- bedded, most rock fragments are granite and pegmatite; <u>Kansan</u> : poorly sorted, contains large amounts of caliche coating and cementing, contains fragments of dark igneous rocks; <u>Nebraskan</u> : generally unconsolidated moderately well sorted, some well- rounded cobbles, 70% sand and finer materials, contains much caliche	<u>Kansan</u> : may represent the period during which the present drainage system was established, caps high buttes on both sides of the Arkansas River; <u>Nebraskan</u> : out of the valley proper and probably represent sheet- type deposits predating present Arkansas River drainage, important source of water for public supply
				<i>Unconformity</i> —no Tertiary- age rocks in the immediate vicinity of Bent's Old Fort National Historic Site	
Cretaceous		Niobrara Formation Smoky Hill Marl Member (Kns) Fort Hays Limestone Member (Knf)	Niobrara Formation (Kn)	Calcareous shale and limestone <u>Smoky Hill Marl Member</u> : predominantly gray, tan, or yellow limy shale and marl, which weathers into a characteristic yellowish orange; bedding plains and joint surfaces often coated with gypsum or calcite crystals; numerous white flakes of calcite give beds a "salted" appearance; <u>Fort Hays Limestone Member</u> : strongly jointed and breaks into flakes parallel to bedding, contains pyrite crystals and limonite nodules	Both members contain layers of bentonite; <u>Fort Hays Limestone Member</u> : fossiliferous and quarried as building stone; Shale of <u>Smoky Hills Marl Member</u> easily erodes; <u>Fort Hays Limestone Member</u> is resistant (forms prominent cliffs)
		Carlile Shale (Kc) Codell Sandstone Member (Kcc) Fairport Chalky Shale Member (Kcf) Greenhorn Limestone Bridge Creek Limestone Member (Kgb) Graneros Shale (Kgr)	Carlile Shale, Greenhorn Limestone, Graneros Shale (Kcg)	<u>Carlile Shale</u> : chalky to calcareous shale, contains thin beds of limestone; <u>Greenhorn Limestone</u> : hard to distinguish from Carlile and Graneros because it contains so much shale, generally dark gray to black	<u>Carlile Shale</u> , <u>Greenhorn Limestone</u> , and <u>Graneros Shale</u> contain thin beds of bentonite; <u>Greenhorn Limestone</u> : quarried for building stone (e.g., original hearth in fort's kitchen is probably Greenhorn Limestone); contains numerous fossils, especially in upper section; resistant to erosion and forms a series of benches (some capped by Illionian and older Wisconsin terrace deposits); <u>Carlile Shale</u> : contains zone of large septarian concretions (as much as 6 ft [1.8 m] in diameter), <u>Codell Sandstone Member</u> is fossiliferous; <u>Graneros Shale</u> : contains thin stringers of gypsum crystals
		Dakota Sandstone (Kd) Purgatoire Formation Kiowa Shale Member (Kpk) Cheyenne Sandstone Member (Kpc)	Dakota Sandstone and Purgatoire Formation (Kdp)	Sandstone and shale <u>Kiowa Shale Member</u> : dark- gray to black shale, very sandy in places; <u>Cheyenne Sandstone Member</u> : lighter color and relatively easily erodible nature distinguish it from <u>Dakota Sandstone</u> ; generally white, compared with yellowish- brown sandstone of the Kiowa Shale Member	<u>Dakota Sandstone</u> : commonly breaks into large angular blocks; quarried for building stone; weathered surfaces are coated with desert varnish, which Indians have chipped away to form pictographs in places; <u>Purgatoire Formation</u> contains marine Comanchean fossils ( <u>Weist</u> and others, 1965); <u>Dakota Sandstone</u> and <u>Cheyenne Sandstone Member</u> : two major artesian aquifers in the area